A

CHEMICO-PHYSIOLOGICAL

INAUGURAL DISSERTATION

ON

CARBONE.

D^r Nathaniel Ritter

with Compliments from

the Author -

A

CHEMICO-PHYSIOLOGICAL INAUGURAL DISSERTATION

ON

CARBONE, OR *CHARCOAL.*

SUBMITTED TO THE PUBLIC EXAMINATION

OF THE

FACULTY OF PHYSIC,

UNDER THE AUTHORITY OF THE

TRUSTEES OF COLUMBIA COLLEGE,

IN THE

STATE OF NEW-YORK:

WILLIAM SAMUEL JOHNSON, LL.D. President:

FOR THE DEGREE OF

DOCTOR OF PHYSIC;

ON THE FIFTH DAY OF MAY, 1795.

By WILLIAM MORREY ROSS,
Citizen of the State of New-Jersey.

——"Ea quæ scimus, pars minima eorum
Quæ ignoramus."——
Præstat naturæ voce doceri quam ingenio suo sapere. CIC.

Late, when the mass obeys its changeful doom,
And sinks to earth, its cradle and its tomb,
—— with nice eye the slow solution watch,
With fostering hand the parting atoms catch,
Join in new forms, combine with life and sense,
And guide and guard the transmigrating Ens.
DARWIN.

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—1795.—

TO

SAMUEL LATHAM MITCHILL, *M.D.*

Profeſſor of Chemiſtry and of Botany in Columbia College,
Fellow of the Royal Society of Edinburgh,
Foreign Aſſociate of the Royal Society of Arts and Sciences at Cape François,
Member of the Philoſophical Society at Philadelphia,
Of the Royal Medical, Chemical, Natural Hiſtory and Phyſical Societies of Edinburgh,
Secretary of the Agricultural Society of the State of New-York,
&c. &c. &c.

Who has ever manifeſted, during my reſidence with him, the moſt friendly attention, and given every aſſiſtance in forming the OUTLINES of my medical education; and who, it is hoped, will receive this *Inaugural Eſſay*, with all its imperfections, as a memorial of eſteem and reſpect, from his friend and pupil,

Wm. M. ROSS.

THE HONOURABLE

JOHN CHETWOOD, *Esq*;

One of the Judges of the Supreme Court of the State of New-Jersey,

&c. &c. &c.

Whose moral, intellectual and juridical endowments are of established pre-eminence:

AND

AARON OGDEN, *Esq*;

In whom are united

The COUNSELLOR and the PATRIOT;

Will also receive this inscription as a respectful tribute to pre-eminent literary, professional and patriotic merit.

The AUTHOR.

A

CHEMICO-PHYSIOLOGICAL INAUGURAL DISSERTATION

ON

CARBONE, OR *CHARCOAL.*

THE following pages are divided into four chapters:

I. The pure and ſimple ſubſtance of carbone, or charcoal, is treated of.

II. Its natural and chemical hiſtory.

III. Its œconomical uſes; and,

IV. The ſubject of carbone is conſidered *medically*.

CHAPTER I.

Of the pure and ſimple ſubſtance, carbone or charcoal.

CARBONE, or pure charcoal, is that ſubſtance which, in chemical nomenclature, is placed among the ſimple bodies, becauſe no experiments hitherto made have proved that it is capable of decompoſition.

It exiſts, ready formed, in the animal and vegetable republics, and alſo in the mineral, as is inſtanced in plumbago or the carburet of iron, &c.

Charcoal may be obtained from vegetable and animal ſubſtances, by incineration; but their ſubjection to *caloric*,

ric, or the *matter of heat*, muſt at firſt be moderate, and afterwards very ſtrong; and for chemical purpoſes, the animal or vegetable ſubſtances containing it muſt be expoſed, in a retort, to the heat of a reverberatory; by which means the ſubſtances capable of being volatilized, or all the parts of the ſubject ſuſceptible of combination with caloric, evolve in the form of gas, and leave the charcoal and little earth or ſaline bodies, as being of a more fixed nature, in the retort.

This ſimple ſubſtance is capable of great durability, and not ſubject to decompoſition like thoſe of the compound ones, as is proved by its being found unchanged in the ruins of cities, decayed foreſts, &c. during the lapſe of ages.*

Carbone is capable too, like many other ſimple ſubſtances, of combination with the *principle of acidity*, or *oxigene:* in the firſt degree of oxigenation, the *carbonous* acid, or *oxyd of carbone*, is produced; and if a ſufficient proportion of *caloric* be added to this, it forms the *carbonous acid gas*, or the *gaſeous oxyd of carbone:* in the ſecond degree of oxigenation, the *carbonic* acid is produced, to which if a ſufficiency of *caloric* be added, it is converted into *carbonic acid gas*.

CHAPTER II.

Its natural and chemical hiſtory.

CARBONE is the baſis of that aëriform fluid which ſeems to have been firſt noticed and deſcribed by John Baptiſt

* 3 Watſon's Chem. Eſſ. p. 48.

Baptiſt Van Helmont; before whoſe time, Paracelſus, and authors previous to and cotemporary with him, thought this gaſeous fluid to be the ſame with the air which we reſpire, although it does not appear they were authoriſed ſo to imagine or conclude, either by arguments, and much leſs by experiments. It was this elaſtic vapour that is evolved from bodies by combuſtion, fermentation and effervescence, that they cauſed to be named *ſpiritus ſylveſtris*.

To this *ſpiritus ſylveſtris*, then, as the predeceſſors of Van Helmont called it, he took upon himſelf to affix the name of *gas*, or *gas ſylveſtre*, which he defines to be "an incoercible ſpirit or vapour, which can neither be collected in veſſels, nor reduced under a viſible form."*

This was the ſtate of knowledge among the chemiſts of his time; ſince which, in modern days, according as it has been found combined with various ſubſtances, it has received different titles, ſuch as *fixed air*,† *mephitic air*,‡ *fixible air*,§ *calcareous gas*,‖ &c. By theſe appellations it was diſtinguiſhed until the year 1770, when it was proved by Bergman to be an *acid*,¶ which has been more fully confirmed by Prieſtley. This diſcovery of Bergman has occaſioned it to be known by the *cretaceous acid*, *mephitic acid*, *aerial* and *atmoſphœric acid*.

B That

* Helmontii Ortus Medicinæ, Cap. Complexionum atque miſtionum Elementalium Figmentum, No. 14.

† Dr. Hales.

‡ Mr. Bewley and Dr. Rutherford.

§ Falconer on fixible air.

‖ Tranſlator of Chemical Dictionary.

¶ 1 Bergman's Chem. Eſſ. p. 3.

That this ſubſtance is an *acid* was proved by our chemical profeſſor———

1. Water impregnated with it, and agitated with the tincture of lacmus, or the litmus paper, turned them red.

2. By the precipitation of lime, from lime-water.

3. By water being highly charged with it, by means of Nooth's apparatus, which became manifeſtly acidulous to the taſte.

4. By its neutralizing alkalies, and cauſing their cryſtallization.*

In a memoir to the Royal Academy of Paris, Lavoiſier relates, he found by experiment, that a certain quantity of charcoal burnt in a given volume of vital or oxigene air, decompoſed it, and produced a gas exactly ſimilar to what is called fixed air, compoſed of charcoal, as an acidfiable baſe and oxigene, and which, according to his ſyſtematic plan, he called *carbonic* acid: but the matter does not reſt on the ſynthetical experiments of Lavoiſier, for Tennant decompounded the fixed air contained in marble, by the intervention of phoſphorus into reſpirable air and charcoal;† however, as they did not appear altogether ſatisfactory, Pearſon repeated them, and has ſhown, that although the compound affinities on which the reſult depended did not *neceſſarily* warrant the concluſion, yet his "well-imagined experiments have in our opinion," ſay the reviewers,

* For a more circumſtantial detail of the teſts of its acidity, the elaborate work of Cronſtedt may be conſulted. (1 Cronſtedt's Mineral. 2d edit. by Magellan p. 320, art. Acidum Aëreum.)

† See Month. Rev. vol. vii. new ſeries, p. 71.

viewers, "ſo fully eſtabliſhed the decompoſition of the fixed air, that we need no longer heſitate in adopting, for this fluid, the name of *carbonic* acid."

This gentleman employed the foſſil and vegetable alkalies inſtead of calcareous earth, as the former contain, in their mild ſtate, a greater quantity of the fixed air, and from their ſolubility in water the charcoal is the more eaſily ſeparable. By following Tennant's proceſs with phoſphorus in glaſs tubes, he obtained 100 parts of mild foſſil alkali thoroughly dried, eight of charcoal in impalpable powder, intenſely black, and ſo light that it occupied the volume of 22 times its weight of water. For the production of this quantity of charcoal, the alkali had loſt ſo much of its fixed air as was equal, in its elaſtic ſtate, to 20 ounce meaſures of water. When the deficiency of air was greater or leſs, the quantity of charcoal varied in the ſame proportion.

Quick-lime and cauſtic alkalies, eſpecially the latter, can ſcarcely be ſo fully deprived of fixed air as not to exhibit, in this proceſs, ſome veſtige of charcoal: but alkalies ſaturated with vitriolic or marine acids yield none, and the quantity of charcoal is in all caſes proportional to that of the fixed air contained in the ſubject and decompoſed in the operation. Quick-lime which had undergone fire in a reverberatory during 48 hours, appeared free from fixed air, and yielded no charcoal: but the pureſt cauſtic alkali that could be procured was found to contain three ounce meaſures of fixed air to 100 grains, and gave a conſiderable quantity of browniſh black powder, five times ſpecifically heavier than

than the charcoal in the preceding operations, and of which only a ſmall proportion was real charcoal.*

This acid, then, which is compoſed of *oxigene*, *carbone* and *caloric*, exiſts in nature in three different ſtates:

1. In a ſtate of combination with ſolid bodies.
2. In a ſtate of mixture with fluids; and,
3. In a diſengaged ſtate of gas.

I. It was proved by Black, in 1755, that fixed air, or, as it is now called, carbonic acid, exiſts in a ſtate of combination in lime-ſtone, which, on its diſengagement, was converted into quick-lime; and this doctrine was ſupported by more facts from the experiments of Prieſtley, M'Bride and Jacquin, which laſt added ſtill further proofs in confirmation, by proving that the cauſticity of alkalies and lime was owing to its abſence.†

It exiſts too, not only in lime and alkalies, but alſo in ſtalactites, in the works of animals called corallines, madrepores, &c. and in their teſtaceous coats or coverings; and it is believed by ſome to be a mere congeries of water-worn ſhells, compacted together by the carbonic acid, that form the baſe of the iſland of Bermuda, which has thus become the habitation of man, plants and animals.

The Society Iſlands mentioned by Captain Cook, of which Otaheite is one, and which is ſaid to be ſurrounded by coral rocks, ſeem, like the former, to have been

* Month. Rev. vol. x. p. 448. Phil. Tranſ. part ii. 1792.

† Pure carbonic acid for medical purpoſes is beſt procured from the Spatum Calcareum of Cronſtedt, by means of the ſulphuric acid; the other acids being not ſo proper, becauſe of their volatility, &c.

been founded from the exuvial matter of animals; and theſe reefs may, like them, become alſo iſlands.

It has likewiſe been ſaid, that carbonic acid is the vinculum of the human ſolid, which is eſpecially aſſerted by M'Bride, who tells us he found it conſtantly produced on the decompoſition of animal ſubſtances. No doubt he was right in recommending for ſeamen the uſe of malt-wort, from which, in its fermenting ſtate, carbonic acid is plentifully evolved; the good effects of which wort were ſufficiently proved in the voyage of Captain Cook, not one of whoſe men died of the ſcurvy alone: but yet his opinion of its efficacy being owing to the preſence of carbonic acid, does not appear to prove *that* acid the vinculum of the living ſolid.

M'Bride ſeems to have been miſtaken in the interpretation of his own experiments, by ſuppoſing, that our ſolids contained fixed air; whereas, on the contrary, our chemical profeſſor proved, that the ſolids contain *not* the carbonic acid, but *merely* the elements, *carbone* and the *principle of acidity*, by which, on their decompoſition, it may be formed.*

II. Carbonic

* The curious experiment by which our profeſſor proved the compoſition of the muſcular fibre was by means of the nitric acid: a piece of the fibrous or lean fleſh of an ox being expoſed, in a moderate heat, to the operation of this acid, there was a production of azotic gas, and a diſappearance of the beef; on ſuffering the apparatus to cool, a greaſy ſcum was found floating on the ſurface of the acid. In this experiment the nitric acid, by getting a ſurcharge of oxigene from the fleſh, is rendered more capable of decompounding it, for then the azote, on being more eaſily diſengaged, unites with caloric, and flies off in the form of nitrogene gas, which leaves the hydrogene and carbone of the fleſh to combine in the oily pellicle, which, on cooling, floated on the ſurface. And thus are the lean and fibrous parts of animals convertible to fat.

II. Carbonic acid exiſts in a ſtate of ſimple mixture in many mineral waters, from which mixture ſuch waters derive the name of acidulæ, acidulous, or petrifying ſprings.*

The Saratoga ſprings, in the ſtate of New-York, are eſpecially remarkable for containing the carbonic acid in this ſtate, which acid may very readily be collected in the form of gas, as is proved by the following experiments of Mitchill.

" A young turkey, held a few inches above the water in the crater of the lower ſpring, was thrown into convulſions

Dr. Mitchill ſaid too he had been in the habit of conſidering that the liver-oil of fiſhes was produced in the ſame way: during the ſpontaneous decompoſition this organ undergoes in a moderate heat, there is an extrication of the azote, which leaves the hydrogene and carbone to form the oil, there appearing to be but little oxygene in the liver. Hence then the great firmneſs of fleſh is owing to the very cloſe affinity or attraction that the elementary ſubſtances oxigene, azote, hydrogene and carbone have for each other.

The muſcular parts are not only decompoſed artificially as in the above experiments, but alſo naturally.

Mr. Sneyd (Phil. Tranſ. for 1792, part ii.) gives an account of the converſion of a bird into a hard fatty matter. It was ſuppoſed to be a duck or young gooſe, and appears to have undergone its change by lying long buried in the mud of a fiſh-pond. The ſkin retains its original ſtructure exactly, but is in great part ſeparated from the fleſh, though both are now compoſed of the ſame ſubſtance, which is in conſiſtence like ſpermaceti, without taſte or ſmell, melts in a ſmall heat, though when congealed again, becomes more ſolid, and looks like wax. For Fourcroy's narrative of analogous changes in human bodies, in the cemetery DES INNOCENTS, ſee Annales de Chimie, vol. v. p. 154; European Magazine, for June, 1794; New-York Magazine, vol. v. p. 493; Chemical Nomenclature, by Profeſſor Mitchill, p. 9.

* An account of a curious ſpring of this kind is related in the xxth vol. of the World Diſplayed, p. 182, the water of which ſeems likely to be iron oxydated by this acid, and perhaps with the addition of a little clay, forming one of the ochres of that metal. In other kinds of petrifying ſprings, bird's neſts, leaves of trees, &c. have been found incloſed in the midſt of petrifactions.

convulſions in leſs than half a minute, and, gaſping, ſhewed ſigns of approaching death; but on removal from that place and expoſure to the freſh air, revived, and became lively. On immerſion again for a minute in the gas, the bird was taken out languid and motionleſs.

" A ſmall dog, put into the ſame cavity and made to breathe the contained air, was, in leſs than one minute, thrown into convulſive motions—made to pant for breath; and laſtly, to loſe entirely the power to cry or move: when taken out, he was too weak to ſtand, but ſoon, in the common air, acquired ſtrength enough to riſe and ſtagger away.

" A trout recently caught, and briſkly ſwimming in a pail of brook-water, was carefully put into a veſſel juſt filled from the ſpring: the fiſh was inſtantly agitated with violent convulſions, gradually loſt the capacity to move and poiſe itſelf, grew ſtupid and inſenſible, and in a few minutes was dead.

" A candle, repeatedly lighted and let down near the ſurface of the water, was ſuddenly extinguiſhed, and not a veſtige of light or fire remained on the wick.

" Theſe experiments nearly correſpond with thoſe uſually made in Italy, at the famous Grotto del Cani, for the entertainment of travellers, as mentioned by Keyſler, Addiſon, and others.

" A bottle filled with the water and ſhaken, emits ſuddenly a large quantity of ærial matter, that either forces out the cork, or makes a way beſide or through it, or burſts the veſſel.

" A quantity

" A quantity of wheaten flour, moiſtened with this water and kneaded into dough, when made into cakes and put into a baking-pan, roſe, during the application of heat, into light and ſpungy bread, without the aid of yeaſt or leaven. From which it appears, that the air extricated from the water is preciſely ſimilar to that produced by ordinary fermentation.

" Some lime-water, made of ſtalactites brought from the ſubterranean cave at Rhinebec, became immediately turbid on mixture with the ſpring-water; but when the water had been lately drawn, the precipitate was quickly re-diſſolved.

" Some of the rock ſurrounding the ſpring, on being put into the fire, calcined to quick-lime, and ſlacked very well.

" When the ærial matter has evaporated, the water loſes its tranſparency and lets fall a calcareous ſediment.

" Whence it is true, that the gas is ærial acid, that the rock is lime-ſtone, and that by means of the former, the water becomes capable of diſſolving and conveying the latter."*

III. The other form in which carbone exiſts in connection with the principle of acidity and the matter of heat, forming carbonic acid gas, is in ſubterraneous grottos, caverns, mines, &c. where it has received, from its deleterious qualities, the name of choak-damp, &c.

It is extricated in this ſtate from wine, mead, verjuice and bread, and from vegetables during combuſtion and fermentation, as was long ago known to Van Helmont,

* Morſe's Geog. vol. i. p. 457.

Helmont, who aſſerts, that it is by means of the corruption of the aliment, and to the evolution of this gas, that we ſhould aſcribe the flatus, &c. in the alimentary canal.*

Carbonic acid gas is evolved too during reſpiration, as may be eaſily proved by paſſing our breath through lime-water, which it inſtantly turns turbid.

Theſe are not the only obſervations of Van Helmont on this gas, for he has mentioned it in ſeveral other places, and particularly in his treatiſe *de Lithiaſi.* cap. iv. No. 7. and in his *Tumulus Peſtis.*

The properties of the carbonic acid are:—

1. When it is in a ſtate of ſimple mixture or combination with water, it is deſtructive to the lives of fiſh, being unfit for their reſpiration, as was proved not only by Mitchill in his experiments on the Saratoga ſprings, but alſo on another ſpecies in the preſence of the chemical claſs.

That it is alike noxious to the reſpiration of plants, when they are expoſed to too great a quantity of it, is ſufficiently evinced by Prieſtley's experiments.

The medical properties of this acid are remarkably evident from the effects of the ſaline draughts of Riverius, from Seltzer water, and from the employment of yeaſt in the New-York hoſpital.

2. That in its gaſeous ſtate it is unfit for animal reſpiration in air, has been long ago obſerved, as we find in hiſtory, which informs us that the two ſlaves

* Tractat. de Flatibus, No. 67 and 68, Perſius, Sat. iii. 99.

Tiberius Cæſar commanded to deſcend into the Grotto del Cano were immediately ſuffocated.

And it is to this gas that Van Helmont,* Morgagni,† Hales,‡ and Addiſon§ attribute the fatality of thoſe who enter the above Grotto, and eſpecially Van Helmont, who conceives it to be entirely owing to this vapour that danger is always preſent in cellars containing fermenting ale, cider, &c. and Pliny ſpeaks alſo of caves from which deadly exhalations ariſe; "and in the territories of the Hirpines," ſays he, "there is that of Amſanctus, a cave near to the temple of Nephites, into which as many as enter ſuddenly die."‖

The deadly effects of the vapours of charcoal, or the carbonous acid, when applied to our reſpiratory organs, were ſadly experienced a few years ago in New-Jerſey, and many other caſes of the like kind have been related.¶

The famous lake of Averno too, in which Virgil tells us is the entrance of the Pandemonian regions, is ſaid to have exhaled ſo great a quantity of this elaſtic fluid, as to have killed birds that attempted to fly over it.**

CHAPTER

* Compl. atque Miſt. Element. Figm. No. 43.

† De Sed. & Caus. Morb. Epiſt. 19.

‡ Statics, 260, 261.

§ Vol. iv. p. 139. See alſo curious experiments on the ſame Grotto, related in 3 Keyſler's Travels, p. 114; 3 Grand Tour, (by Nugent) p. 404; Encyclopæd. Brittan. art. Grotto; Tours by Brydone, Moore, &c.

‖ C. Plinii Nat. Hiſt. tom. 1. lib. ii. Cap. xciii. De Miraculis Terrarum.

¶ L. Annaei. Senecae ad Lucilium Nat. Quæſt. lib. vi. 28. In quo de terræ motu agitur. Mead. de Venenis, tent. 6. 4 Hoffman, p. 697. No. 22. ꝛ Percival, Eſſ. vi. &c.

** Virg. Æn. vii. l. 82.—Æn. vi. l. 237, & Notæ. This, however, does

CHAPTER III.

Œconomical uſes of carbone and its compoſitions.

1. CHARCOAL is uſed in the compoſition of gun-powder, and the purer it is, the ſtronger and better will be the powder. Charcoal, which is generally produced by the incineration of vegetables, and uſed for this purpoſe, and which approaches neareſt to chemical exactitude, is ſaid to be procured from the Corylus of Linnè. It is uſed in gun-powder becauſe of its great combuſtibility, which is derived from its colour and natural attraction for oxygene; for the carbone firſt decompounds oxygene air, which produces that temperature in which the ſulphur becomes alſo capable of the ſame proceſs, and both theſe more effectually by the great quantity of oxygene the nitre affords.

The chemical affinities of the ingredients of gun-powder may be underſtood by the following table:—

Gun-powder, { Nitre, { Pot-aſh. / Nitrous Acid, { Azote, / Oxigene. ; Sulphur. ; Carbone.

Theſe ingredients in and after exploſion form other compounds, according to their reſpective chemical affinities:—

Oxigene

not appear to be the caſe now, as Silius Italicus (lib. xii.) informs us that the noxious vapours which iſſued from Lake Averno in the days of Hannibal were entirely diſſipated by the free acceſſion of air ſince the felling of the woods that ſurrounded it by the order of Aggrippa.

Oxigene and Sulphur	form	Sulphuric Acid.
Sulphuric Acid and Pot-aſh		Cubic Nitre.
Oxigene and Carbone		Carbonic Acid.
Carbonic Acid and Pot-aſh		Mild Alkali.
Azote and Caloric		Azotic Gas.
Pot-aſh and Sulphur		Hepar Sulphuris.
Azote and Oxigene (1ſt degree)		Oxyd of Azote.
Oxigene and Caloric		Oxigene Gas.

Hence then, from theſe new combinations taking place, we eaſily underſtand that the exploſive force of gun-powder no longer remains a problem in chemiſtry, as it is demonſtrated to depend upon the formation and extrication of different gaſſes, and that as the ingredients of the gun-powder bear to each other an exact ratio of proportion, will its ſtrength and exploſive capacity be increaſed.

The other new combinations that are formed and become more fixed, are alſo eaſily comprehended, for we find that in inſtruments wherein this compoſition is exploded there remains a reſiduary fœtid compound, which appears to be the ſulphure of pot-aſh, coloured by means of the charcoal, &c.

Father Kircher ſays,* we ought to attribute the diſcovery of the above compoſition to Barthold Schwartz, or Barthold the Black, a monk of Goſlar, in Germany, a man of profound knowledge in alchemiſtry. This man having made a medicinal mixture of ſulphur, nitre and charcoal, it happened that a ſpark fell into it, and cauſed it to explode with the moſt dreadful violence. This ſo aſtoniſhed the monk that he

* Mundus Subterraneus, p. 487.

he repeated the experiment, and more fully diſcovered the nature and properties of gun-powder in 1354.

The invention of gun-powder ſeems alſo to have been attributed to the ſame German by Polydore Vergil,* who thinks him too ignoble to have his name handed down to poſterity.

The compoſition of gun-powder by ſome, however, is ſuppoſed to be of more ancient date, for Lord Bacon ſays ordonance had been uſed in China 2000 years ago.†

——" Taught myſterious Bacon to explore
" Metallic veins, and part the droſs from ore;
" With ſylvan coal in whirling mills combine
" The cryſtall'd nitre, and the ſulphurous mine;
" Through wiry nets the black diffuſion ſtrain,
" And cloſe an airy ocean in a grain."‡

Charcoal is alſo uſed in the *arts*, for the purpoſe of diſoxigenating bodies, and eſpecially by metallurgiſts, who are thereby aſſiſted in the aſſaying of ores, and reducing them to their reguline or metallic ſtate.

* Polyd. Verg. de Inven. Rerum, lib. ii. cap. 11.

† Eſſay on the Viciſſitudes of Things. For a more full account of the compoſition of gun-powder, ſee Watſon's Chem. Eſſ. vol. i. p. 327.

‡ Gun-powder is plainly deſcribed in the works of Roger Bacon before the year 1267. He deſcribes it in a curious manner, mentioning the ſulphur and nitre, but conceals the charcoal in an anagram. The words are, ſed tamen ſalis petræ LURE MOPE CAN UBRE et ſulphuris; et ſic facies tonitrum, et corruſcationem, ſi ſcias, artificium. The words lure mope can ubre are an anagram of carbonum pulvere. Biograph. Brit. vol. i. Bacon de Secretis Operibus, cap. 11. He adds, that he thinks by an artifice of this kind Gideon defeated the Midianites with only three hundred men. Judges, cap. 7. Chamb. Dict. art. Gun-powder. As Bacon does not claim this as his own invention, it is thought by many to have been of much more ancient diſcovery. Darwin Cant. i. l. 237. 1 Watſon's Chem. Eſſ. p. 335.

ſtate. It is this ſimple ſubſtance too, on its exilition in the gaſeous form from the alkali, that makes the ſudden exploſion in *Pulvis fulminans*, when the ſulphur and alkali combine, and form a hepar or ſulphure which is coloured by the charcoal.

2. In a ſtate of combination with the carbonates of lime, ſuch as chalks, marbles, lime-ſtones, marles, teſtaceous ſhells, &c. it is uſed for agricultural purpoſes,* and appears to be a natural and conſiderable ſtimulant on the abſorbent ſyſtem of vegetables, enabling them to take in a greater quantity of nouriſhment and to become more vigorous; and our profeſſor of agriculture † delivers it as his opinion, that the carbonates of lime act pretty much like the gypſums, not ſo much by yielding nouriſhment themſelves, as by operating on the excitability of plants, giving them greater appetency for food, ſtrengthening their digeſtive powers, and thereby enabling them to grow with increaſed energy and luxuriance. And it ſeems to be that lime which, in its cauſtic ſtate, is ſcattered over fallow land by farmers, becoming carbonated or neutralized by this acid, that affords that wholeſome ſtimulus to the future crop; for, were this not the caſe, the lime would ſoon deſtroy them, as it is well known to do both vegetable and animal ſubſtances in its ſtate of purity or cauſticity; though even in this ſtate it may be advantageouſly employed in ſome caſes to quicken the decay or decompoſition of dead vegetable matter, as in dung-heaps, &c.

The

* Fordyce's Elem. Agric. Anderſon. Agric. Kaimes' Gent. Farm. &c. &c.
† Mitchill.

The carbonic acid not only appears to be a conſiderable ſtimulant to vegetables, but they would alſo ſeem to decompound it, for the purpoſe of receiving its baſe into their conſtitutions, and this ſeems countenanced from what has been related concerning the experiments of Myer.*

Although it has long been diſputed by chemiſts, phyſiologiſts and agriculturaliſts, whether or not charcoal exiſted, and was formed naturally by the vegetable œconomy; yet, from theſe late obſervations it is found true beyond doubt, that it is a ſubſtance procured *ab extrà*, and when taken in becomes an ingredient in the ligneous part of the vegetable:† and by this mean may vegetables purify the atmoſphere, not only by their extrication of vital air, but alſo by decompoſing the carbonic acid or its gas: and hence we perceive that this acid is decompoſed naturally as well as artificially, when in the former it goes to combine with the hydrogene of the vegetable, and thus forms their oils and reſins, &c. it being to be conſidered, that the moſt valuable manures contain very large proportions of a carbonaceous ſubſtance, as in ſwamp manure, cow-yard manure, &c. and that the exhauſtion of

* Muhlenberg's Letter to Mitchill on the cultivation of the AVENA ELATIOR—GYPSUM and STONE COAL as a manure, &c. Tranſact. Agric. Soc. of New-York, for 1794, part ii. p. 215. See an experiment to the ſame effect made by Senebier, related in 3 Chaptal's Chem. p. 32, and by Haſſenfratz, Annales de Chimie. Month. Rev. new ſeries, vol. xi. p. 540.

† This appears to be the caſe eſpecially with the SPHAGNUM PALUSTRE of Linnè, which is of ſo entirely a carbonaceous ſtructure as to continue for a great length of time undecompoſed, when covered with ſtrata of earth, as may be ſeen near New-Town, on Long-Iſland, &c.

of the fertility of ſoil in old cleared land is owing in a great degree to the conſumption by vegetable abſorption of that carbonaceous ſtratum of dead leaves, decayed and rotten trees, &c. which, on the firſt ſettlement of the country covered the ſurface of it. And the fertility of all our lands appears to be in a conſiderable degree owing to the leading ingredient—carbone.

3. In a ſtate of mixture with water; and, 4thly, in a ſtate of gas it may be uſed œconomically in the making of bread, as Mitchill not only proved in the experiments at Saratoga, but alſo in a ſtate of gas, as appears by the following extract:—" Why are barm, yeaſt and leaven, and other like ſubſtances, neceſſary to raiſe fermentation in bread? It is not neceſſary that bread undergo fermentation in order to be good; but it is ſimply requiſite that a quantity of fixed air ſhould be extricated to raiſe and puff it up. This divides and parts aſunder the dough, and renders it porous and ſoft, prevents exceſſive toughneſs and hardneſs, and makes the bread eaſy to be broken, cut and eaten: further, fixed air, although a poiſon when applied to the organs of ſmell and reſpiration, is an agreeable ſtimulus when taken into the ſtomach, and may operate, when an ingredient in bread, juſt as it does in porter and other malt liquors. What good does pot-aſh do in cakes? Pot-aſh contains a great portion of fixed air, which is ſet at liberty by the heat neceſſary to bake the cake; and therefore pot-aſh ſuperſedes the uſe of fermenting mixtures. How is the water of Saratoga ſpring uſeful? In the ſame manner. The water

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is decompoſed by the heat, lets go the fixed air, which inſinuates itſelf into the bread, and cauſes it to be light and ſpungy. For what reaſon are holes pricked into loaves of bread? The heat of the oven not only ſets free a large quantity of fixed air, but alſo greatly rarifies it: if, therefore, there be no outlet given to it, the loaf would be burſted in an unſightly manner, or an extenſive bliſter would be formed beneath the upper cruſt, to the damage of the bread."*

Carbonic acid may not only be œconomically applied in the making of bread, but alſo from late obſervations in the making of vinegar, as appears from the experiments of Chaptal, who, by means of water being impregnated with near about its own bulk of this acid, and expoſed in a cellar where it had free ventilation, found all that was contained in the veſſels in a ſhort time converted into acetous acid; and as there appears to be nothing wanting but a preſence of hydrogene gas, and that particular temperature in which this change may be wrought, it is not improbable that in time this will be found a very cheap, eaſy and expeditious way of ſupplying ourſelves with this article.

It has been ſuggeſted by Percival as deſerving trial by floriſts and horticulturaliſts, when combined with water;† and from what has been ſaid on the agricultural uſe of lime, &c. modified by this acid, it would ſeem very likely to produce good effects, as the acid may be decompounded in his experiments as well as in thoſe above related.

* See "Sketch of the Philoſophy of Houſe-keeping," &c. American Muſeum for October, 1790, p. 179.

† 2 Med. Eſſ. p. 147.

CHAPTER IV.

The ſubject of carbone conſidered medically.

IF it be true that the ſubſtances compoſing the ſanguineous, nervous and muſcular parts of our conſtitutions ſhall at different times exiſt in greater or leſs proportion, or poſſeſs greater or leſs attraction for each other than is conſiſtent with the health and well-being of our bodies; it follows, that when there ſhall be an abſence or ſurpluſage of one or more of the ingredients forming the compound, the ſubſtance or ſubſtances ſo abſent, or if they are preſent and exiſt in a too great or ſmall quantity, that diſeaſe muſt be induced correſponding to the preſent ingredients and their tendency to form new combinations: and hence it appears, that the materials forming our bodies muſt exiſt in a certain ratio of proportion with regard to each other, in order to conſtitute health; every departure from which ratio will produce prediſpoſition if not actual diſeaſe.

That diſeaſe ſometimes ariſes from a diſproportion of the ingredients or materials forming the blood and the muſcular compages of our fleſh, will be ſufficiently apparent by attending to the phænomena that are chiefly conſpicuous in the ſymptoms of the two diſeaſes of phthiſis and ſcorbutus, or conſumption and ſcurvy: the former to be conſidered as depending upon or occaſioned by an *exceſs*, and the latter by a *deficiency* of the oxigenous principle; accompanied in the former with a *diminution*, and in the latter with an *increaſe* of the carbonaceous

carbonaceous material.—And firſt then of *Phthiſis pulmonalis*.

PHTHISIS.

FOR the better explanation of the ſymptoms of this diſeaſe, we ſhall conſider it under the three following heads, which are perhaps as juſt characteriſtics as any of the complaint.

I. The remarkable loſs of fat, and often of muſcular ſubſtance apparent in it.

II. That happineſs, cheerfulneſs and ſerenity of mind which attend it: and,

III. The fever for which it is remarkable.

I. The remarkable loſs of fat and often of muſcular ſubſtance that is manifeſted in conſumption, even to the extreme leanneſs ſo conſpicuous in the *facies hippocratica*, may probably be explained on the ſuppoſition of an *exceſs* of the acidifying principle in the following manner:—The oxigene may unite with the carbone of our fleſh, during the temperature of the ſyſtem occaſioned by means of the fever, which increaſed degree of heat cauſes a greater attraction of the carbone for the oxigene than before exiſted, and by uniting with it and caloric, flies off in the form of carbonic acid gas, and takes away the baſis of the muſcles and fat: the baſis of the fleſh, being thus diſſipated, leaves the other ingredients in greater attractive force * for each other than they

* "CARBONIC MATTER long ſince preſented itſelf to my mind as likely to be ſerviceable in diſeaſes, where we ſhould deſire to deprive the ſyſtem of oxigene. Its great attraction for oxigene, in high temperatures, has long been known; and the experiments of Mr. Lowitz, and ſtill more the very ſurpriſing ones of Dr. Kels, (CRELL'S ANNALEN, ſt. 3. 1792) and of Dr. Buckholz,

they poſſeſſed before; ſo that they alſo may unite and form new combinations, as part of the hydrogene may combine with the carbonic acid during its formation and evolution from the ſurface of the body, and form that colliquative or clammy ſweat which is ſo conſtant a debilitant in conſumption. Part of the hydrogene too, may combine with the oxigene, and produce the dropſical ſwellings ſometimes obſervable in that complaint; and moſt other atrophial diſeaſes, whether they ariſe from defect of nouriſhment or from meſenteric obſtructions, may, like the conſumption, be owing to a deficiency of the radical of the carbonic acid; and it would ſeem to be by this combination of oxigene, carbone and caloric flying off in the form of gas, that occaſions emaciation, not only in this complaint, but in all fevers whatſoever.

II. The ſerene and cheerful diſpoſition which patients in conſumption almoſt always poſſeſs, may alſo be owing to an exceſs of the ſame principle; and it may not be unlikely, that it acts immediately on the *vital ſolid, or living moving powers, which appear to be ſo delicately organized, and to poſſeſs that peculiar excitability, capacity, or ſuſceptibility of impreſſion*, that when oxigen, its *natural* ſtimulant or excitant, ſhall be applied, an effect or an excitement is produced; which *quality*, thence ariſing from effects ſo produced, is what is

(Gren's Journ. der Physik. B. v. p. 3.) ſhew that at a temperature conſiderably below that of warm-blooded animals, carbonic matter is by no means ſo inert a ſubſtance as it has hitherto been reputed. Dr. Moench (V. d. Arzney-mitteln, p. 221.) aſſures us, that he has given it largely with ſucceſs." Beddoes' Letter to Darwin, p. 68.

is called Life; and in proportion as such application shall be made and continued, will be the effect and continuance of this pleasant quality in the system, as is instanced in all the intermediate degrees of the state of mind in scurvy and consumption.

But this *quality*, *aptitude* or *relation* which the vital solid possesses of being operated upon by its *natural* stimulant, oxigene, may at length be worn out of its excitability, as is proved by animals being exposed to an atmosphere of pure vital air, who shortly after died; not from the irrespirability of the air, for animals could live in it afterwards, but from this *animal capacity* being destroyed by means of the indirect debility the gas produced on their systems; and hence the above quality must cease, and cessation of life, or death as it is called, must ensue. Therefore *excitement*, which is an *effect* produced by the above exciting power, acting upon the excitability of the vital medullary system and irritable fibre, and which is commonly called life, or the vital principle, would not seem to be a *distinct substance* added to the body, but merely the modification or organization of the component atoms in a specific manner, and with due proportions of each of the elements; which organization and proportion are conditions necessary to life, and the destruction of which in all cases produces or accompanies disease or death:—This then, this is the *magnum arcanum naturæ* in this case of animated existence; that animals, when this *quality* shall cease to exist, *die—to be succeeded by other animals*; *and that the same materials that formed the one animal*,

animal, may, after its death, go to the formation of another.

That the cheerful diſpoſition of mind in conſumptive patients is occaſioned by a ſuper-oxigenated ſyſtem, would ſeem as fully rational and concluſive as that of the great Haller, who would feign believe that this ſtate of exhiliration, wherein the bodily powers were waſting away by diſeaſe, manifeſted a "*certain ſomewhat*," which argued an immortality of the ſoul.*— However, were we to form a juſt and accurate concluſion from the facts and obſervations above related, we could not be led to an explanation of the cauſe of that "*certain ſomewhat*" which occaſions hilarity in theſe patients, as Haller has done; but, we muſt conſider *life as an effect produced by the action of ſtimuli, and particularly of the oxigenous principle, upon the excitability of the muſcular and nervous ſyſtem*; and hence, *that it is not a principle, but a condition—not a ſubſtance, but a quality of a ſubſtance.*

That it is the *oxigenation* of the ſyſtem which occaſions the above *quality* or diſpoſition of mind, and that this will be effected in proportion as the ſyſtem ſhall be ſo oxigenated, will not only appear from the cheerfulneſs it inſpires on breathing it, but be made further apparent hereafter, when the ſymptoms of a diſeaſe ſuppoſed to be induced from *diſoxigenation*, or a *deficiency* of the ſame principle, ſhall be taken into conſideration.

It

* viii. Haller. Element. Phyſiolog. lib. xxx. § 23. Signa Mortis.

It may not, however, be deemed improper to adduce here another argument in ſupport of what has already been ſaid concerning the exhilaration of mind in conſumption, which appears to be dependant on the ſame cauſe, and exiſting in proportion to the degree it ſhall be applied; it is this, that in general females are remarked to be more ſubject to this complaint than males; ſo alſo it is well known they poſſeſs greater irritability, that their imagination and vividity of thought far exceed thoſe of males; all of which ſymptoms are clearly the effects of their ſyſtems being comparatively oxigenated in a greater degree than the males; and this is remarkably illuſtrated by an obſervation made by Pliny, who ſays, "The blood of males is commonly blacker than that of females;"* which change of colour Prieſtley has long ago proved to be owing to the influence of oxigenous air.

Since then it is the principle of acidity that enters and becomes part of the ſolid ſubſtance of our bodies, and occaſions that ſtimulation on the excitability of our nervous ſyſtems, &c. which produces the phænomena of a living ſtate, we may with great facility explain many of its functions, which ſeemed formerly to have eluded the obſervations and reſearches of the moſt diligent phyſiologiſts: we have already explained ſome of the moſt difficult, that at firſt ſight ſeemed to have been inſcrutable; and the other powers that follow, diſtinguiſhing dead from living matter, are the internal ſtimuli themſelves; "the functions of the ſyſtem itſelf producing

* Nat. Hiſt. tom. i. lib. 11. cap. 38.

producing the ſame effect are muſcular contraction, the exerciſe of ſenſe, the energy of the brain in thinking, and in paſſion and emotion." Theſe, together with the external ſtimulant power of oxigene after its application, produce the ſame effect, and life, or the quality of animation, is therefore found to be *excited* by their mutual co-operance; and hence "*is a forced ſtate of exiſtence.*"

This conſequent performance of functions, when the ſtimulus of oxigene ſhall be applied to a ſyſtem, poſſeſſing a *capacity* of being rouſed to life, will alſo probably explain, among other of its functions, the circulation of the blood, without accounting for it on the ſole action of the heart, or aſcribing it chiefly to the effect of muſcular fibres, by ſome ſuppoſed to exiſt in the vaſcular ſyſtem: on the contrary, it would appear to be almoſt entirely explicable on the above ſuppoſition: and indeed, though the heart or muſcular fibres ſhould be admitted to have a tendency to aid the circulation of the ſanguineous fluid, yet this appears to be only in proportion as the blood ſhall be oxigenated, and thus operate on their excitability: and that they have no ſuch great agency is further demonſtrated by the circulation exiſting in a human creature born without heart or lungs, wherein the circulation between the fœtus and the mother continued by means of the umbilical cord and placenta, ſo as to ſtimulate the arteries to action, until, after birth, when the ceſſation of the oxigenating proceſs,*

* ——"The fœtus has its blood oxigenated by the blood of the mother through the placenta. During pregnancy, there ſeems to be no proviſion for the reception of an unuſual quantity of oxigene. On the contrary, in conſe-

proceſs, on account of the want of reſpiratory organs, was directly followed by death.*

It is alſo probable, that oxigene is the cauſe of irritability, from this quality being greateſt in parts where moſt blood is ſent; and where this is abſtracted, the vital principle, as Hunter calls it, muſt alſo ceaſe, as he proved by his experiments in the bleeding of animals: and, on the contrary, where there ſhall be leſs ſent, or where it ſhall loſe the property of being arterial, thoſe parts will be leſs ſenſible, as is evidently perceived in the liver, &c.

Animals too, poſſeſſing a great quantity of oxigene, are alſo moſt irritable, as is perceived in the tortoiſe, which will exceedingly well apply to prove that the circulation of the blood is carried on by the means above ſtated: for Mitchill relates an experiment made by himſelf, wherein, after withdrawing the blood and injecting water in its place, he found that the heart

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quence of the impeded action of the diaphragm, leſs and leſs ſhould be continually taken in by the lungs. If, therefore, a ſomewhat diminiſhed proportion of oxigene be the effect of pregnancy, may not this be the way in which it arreſts the progreſs of phthiſis? and if ſo, is there not an exceſs of oxigene in the ſyſtem of conſumptive perſons? and may we not, by purſuing this idea, diſcover a cure for this fatal diſorder?" Beddoes' Obſerv. on Calculus, &c. p. 114, 116.

He goes on further to ſay, that "pregnant women agree with ſcorbutic patients in that ſtrong inſtinctive appetite for vegetables; and it appears as if this diet was the moſt ſuitable to them."

"Pregnant women," ſays Dr. Denman, "have generally a diſlike to animal food of every kind, and under every form—on the contrary, they prefer vegetables, fruit, and every thing cooling, which they eat and drink with avidity, and in which they indulge without prejudice." Introduct. to Midw. p. 249. See Review of Beddoes' Obſervations, &c. 8 Duncan's Med. Com. p. 79.

* See a Deſcription of a Human Male Monſter, by Dr. Monro, iii. Tranſ. Roy. Soc. Edin. p. 215.

would contract and propel the water for ſome time, until, for want of a freſh ſupply of oxigene, it ſtopt. This irritability is well known in the eel, turtle, &c. and many of the claſs of amphibia of Linnè.

Oxigene, however, may not only be the cauſe of irritability in the inſtances already mentioned, but may alſo produce this quality in vegetables, as in the mimoſæ, &c. and in all organized matter whatſoever poſſeſſing a *capacity* of being operated upon by it.

III. The fever which attends conſumption would alſo ſeem to be confirmative of the above doctrine, and will perhaps be of extenſive application to the explanation of fever in general, eſpecially that of the ſynocha, in which a phlogiſtic, or what perhaps would be a more accurate expreſſion, an oxigenated diatheſis of the blood, exiſts to ſo great a degree that phlebotomy is often employed to decreaſe the action of the heart and arteries.

That fever is occaſioned by an exceſs of this principle has been fully proved by the expoſure of animals to an atmoſphere of oxigene air, when they have ſhewn all the diagnoſtics of fever and inflammation. This then being the fact, we can eaſily underſtand why phthiſis is attended with fever, ſince it is evident, that ſuper-oxigenation is the cauſe of the complaint; for the oxigene, on account of its great attraction for caloric, always carries a great quantity of it in a combined ſtate; and this oxigene itſelf may perhaps be decompoſed by means of the vital ſolid, and thus not only produce irritability, but alſo occaſion a greater evolution of its heat

heat from a ſtate of combination to that of a liberated form; thus conſtituting febrile heat, which produces that degree of temperature in the ſyſtem, by means of which the oxigene, &c. will the more ſtrongly be attracted by the materials compoſing the adipoſe and muſcular parts of our bodies, and thus, by forming new combinations, fly off in the form of gas, and produce, in part by theſe effects, the diminution of bulk and ſtrength that is obſerved in fevers, eſpecially thoſe that are terminated by colliquative ſweats; and it is this thermometric heat paſſing again to a latent ſtate in the perſpiratory matter on the ſurface of the body that in ſome caſes occaſions the ſenſation of chillineſs and coldneſs of which patients complain.*

Inflammatory

* Since writing the above, Beddoes' letter to Darwin, on the ſubject of "a new method of preventing pulmonary conſumption," has come to hand, from which the following extract is ſelected, that the reader may draw ſuch inferences as may be ſuggeſted from a compariſon of what has been delivered with the experiments of that celebrated phyſician:——

"After ſecuring a full ſupply of oxigene air, the firſt thing I undertook was to attempt to throw ſome light upon the nature of conſumption by an experiment upon myſelf. Not having any thing of the phthiſical conformation or the ſlighteſt hereditary claim to the diſeaſe, I thought I might venture very far in oxigenating myſelf without any great riſque; and it was impoſſible for me to obſerve the effects ſo minutely in another perſon. I accordingly reſpired air of a much higher than the ordinary ſtandard, and commonly ſuch as contained almoſt equal parts of oxigene and azotic air, for near ſeven weeks, with little interruption. I breathed it upon the whole ſometimes for twenty minutes, ſometimes for half an hour, and ſometimes for an hour in the day; but I never continued breathing for above four or five minutes at any one time. I felt, at the time of inſpiration, that agreeable glow and lightneſs of the cheſt, which has been deſcribed by Dr. Prieſtley and others. In a very ſhort time I was ſenſible of a much greater flow of ſpirits than formerly, and was much more diſpoſed to muſcular exertion. By degrees, my complexion, from an uniform brown, became fairer and ſomewhat florid. I perceived a carnation tint at the ends of the fingers, and on all the covered parts of the body the ſkin acquired

Inflammatory fevers prevailing moſt generally in northern and leſs in ſouthern climates, may alſo poſſibly be owing to the ſyſtem having greater opportunity of becoming ſurcharged with oxigene and caloric in the former than in the latter, and if ſo, conſumptive patients will grow better in a warm than in an oppoſite ſtate

much more of a fleſh colour than it had before. I was rather fat, but during this proceſs I fell away rapidly, my waiſtcoats becoming very much too large for me; I was not ſenſible, however, of my muſcular emaciation, but rather the contrary. My appetite was good; and I eat one-third or one-fourth more than before without feeling my ſtomach loaded. In no long time I obſerved in myſelf a remarkable power of ſuſtaining cold. Except one or two evenings when I was feveriſh, I never once experienced the ſenſation of chillineſs, though cold eaſterly winds prevailed during great part of the time I was inſpiring oxigene air. I not only reduced my bed-clothes to a ſingle blanket and cover-lid, but ſlept without inconvenience in a large bed-chamber, looking to the N. E. with the window open all night, and with the door and windows of an adjacent fitting room alſo open. About the expiration of the above-mentioned time, I perceived ſome ſuſpicious ſymptoms. It was uncomfortable to me to ſit in a room at all cloſe. I frequently felt a ſenſe of heat and uneaſineſs in my cheſt; and my ſkin was often dry and hot, with burning in my palms and ſoles; my pulſe, which had hitherto ſeldom exceeded eighty, was above ninety in the evening. At this time I took a journey of about 170 miles, the greater part in a mail coach in the night, the reſt on horſeback. The roads were uncommonly duſty, and ſeveral circumſtances concurred to harraſs and fatigue me. On the way I met with a medical friend, who was much ſtruck with the fluſhed appearance of my countenance; and upon feeling my ſkin and pulſe, which varied from an hundred and four to an hundred and twenty, imagined that I was become hectic. I had now, though but ſeldom, a ſhort, dry cough; but the ſenſe of irritation to cough required an almoſt conſtant effort to ſuppreſs it: this ſenſe of irritation was, as you will ſuppoſe, attended by dyſpnœa. I had alſo frequent bleedings at the noſe, an event almoſt unprecedented with me; the blood was of an unuſually bright colour; which was alſo ſeen in blood forced from the gums. Whenever I pierced the ſkin in ſhaving, the blood flowed in greater abundance than uſual, and was ſtaunched with difficulty."

In confirmation of what is related in the above caſe, and of the injurious effects of vital air in conſumption, may be added Fourcroy's relation of the caſes of twenty patients in this complaint, whom he cauſed to reſpire oxigene gas. Beddoes' Obſ. p. 126; extracted from Annales de Chimie, iv. 85.

ſtate of the atmoſphere, which is found to be the fact. Adoleſcents too, who poſſeſs a great ſtock of accumulated excitability, will, on their ſyſtems becoming highly oxigenated, be more lively and ſprightly than elderly perſons, who, on the contrary, from a deficiency of excitability, are more apt to be melancholic. So alſo will this oxigenous principle, acting upon the vital medullary ſyſtem of young people, explain why they are more ſubject to fevers of the order of phlegmaſiæ, as well as to conſumptions; while thoſe of advanced years labour under indigeſtion, &c. and many diſeaſes of the claſs of neuroſes; partly from a worn-out excitability, and partly from a deficiency of the vivifying and invigorating ſtimulus that oxigene affords.

CURE.

THE cure of conſumption, if what has been advanced be founded in truth, muſt depend upon a renewal of the ſubſtance or ſubſtances that the ſyſtem is ſuppoſed to have loſt: and that carbone or charcoal is the principal abſent material in phthiſis, which forms the connection or bond of union between the other ingredients, ſhall be endeavoured to be made apparent by the numerous facts which we ſhall now conſider.

It appears that carbone is the principal loſt material conſtituting our fleſh and fat, not only by the analyſis already related, but alſo from the great debility, and on the contrary from the increaſe of ſtrength obſervable when it is ſo exhibited as to re-enter, and form again a conſiderable

conſiderable proportion of our fleſhy fabric; and it ſeems to be by the agency of the ſame material that the preſent complaint is either palliated or removed, even when ulceration of the lungs takes place: it would alſo appear to be on this doctrine of carbonating the ſyſtem, that we are to explain the popular opinion of longevity being moſt frequent, and the benefit patients in phthiſis experience by living in places where this gas is abundant.* It is even ſaid too, there have been inſtances of people in confirmed conſumption being entirely cured by occupations where this gas is conſiderably evolved, ſuch as from lime-kilns, breweries, tan-yards, &c. &c.

That carbonic acid gas has been beneficial in conſumption, receives further corroboration from the experiments of Percival, who, having exhibited it to many of his phthiſical patients by way of reſpiration, ſays, "the hectic fever has in ſeveral inſtances been generally abated, and the matter expectorated has become leſs offenſive and better digeſted."† This operation of the gas may perhaps yield an eaſy explanation;—on inſpiration it may have a power of diminiſhing the irritability of the lungs, which it may effect by abſorbing a large proportion of their oxigene, which has been conſidered above as conſtituting this quality; and alſo, on being

* 1 Percival's Eſſ. p. 460.—It is ſaid, that conſumptive patients in Germany are ordered to be placed in ſtables, among their horſes, cattle, &c. from which practice they experience great relief: and on the ſame principle are we to explain the benefit ſuch patients have received from the burning of reſins, &c. in cloſe apartments.

† 1 Eſſ. p. 308; and 1 Prieſtley, &c. p. 301. Append.

being received into the ſyſtem, there will be a fixation of a part of it, and as the oxigene will be as it were neutralized, the preſence of it will thus be no longer active. It will alſo operate beneficially by reducing the quantity of pure gas inhaled at each dilatation of the lungs, and conſequently diminiſh the quantity of the principle of acidity derived to the blood and thence to the ſolids and ſecreted humours, from that ſource.

While this proceſs is going on, or as the ſyſtem ſhall become again more carbonated, there will of conſequence be an alteration in the purulent matter through which the gas is received; and this too ſeems to be by the pus there formed poſſeſſing a more fluid or having a leſs tenacious conſiſtence, and being more offenſive before than after the exhibition of this remedy: the operation of the carbonic acid gas, then, in theſe laſt ſymptoms, is probably by its becoming united with part of the hydrogene, which before was not wholly combined with the ſmall quantity of carbone forming the purulent compound; but its now becoming united with the ſuper-abundant hydrogene, the pus will take on a more tenacious and firm conſiſtence; and in proportion as this ſhall be effected will the offenſiveneſs of expectoration diminiſh; for it would ſeem, that the great quantity of caloric at firſt carried by the oxigene in a ſtate of combination, and there partly extricated, ſhould eaſily volatilize the hydrogene, azote, and other ſubſtances with which they were united, and which were probably in ſuch ſlight attachment that they might be eaſily decompounded, and forming other combinations, ſuch as

phoſphorated

phoſphorated or carbonated hydrogene gaſſes, &c. be thus volatilized by the agency of thermometric caloric. This being the caſe, while circumſtances continue in the above ſituation, the pus muſt naturally be changed when the charbonic acid gas ſhall be exhibited, which requires a greater quantity of caloric to ſuſpend it than the other gaſſes, and which, when it ſhall combine as already mentioned and render the diſcharge more fixed, muſt of neceſſity prevent any further decompoſition, and will cauſe it to be a more mild and digeſtive pus. This may alſo with equal propriety hold good with ulcers on the external ſurface of our bodies, which are well known to receive much injury from expoſure to air; and as the good effects of applications to them, containing the *elements* by which this gas is formed, have long been experienced, it may not, perhaps, be unworthy of trial to expoſe ſuch ulcers to an atmoſphere of this gaſeous fluid.

But the inſpiration of the carbonic acid gas is not the only way by which the ſyſtem may regain its loſt ingredient, for it may alſo be received, and poſſibly with more effect, from ſuch ſubſtances being taken for food or drink as contain it, viz. animal food, malt liquors, &c. all of which poſſeſs but a ſmall quantity of the oxigenous principle: and hence, by the employment of this diet, the carbone, azote, &c. of which they are compoſed, may eaſily be received into the ſyſtem by the operation of the chylopoietic viſcera.

That this treatment is juſt and proper is further confirmed by the experience of convaleſcents and emaciated perſons,

perſons, who ſometimes grow fat even to obeſity, unleſs there ſhould exiſt ſome meſenteric obſtruction. This increaſe of corpulency may not unlikely be effected by means of the hydrogene that ſtill remained in the emaciated habit, which, upon the admiſſion of a freſh ſupply of carbone, united with it and formed the ſebaceous compound; and this may have been the caſe with thoſe perſons who recovered from the yellow fever in Philadelphia, many of whom, it has been ſaid, were obſerved to increaſe in fatneſs.

Conſumption, however, may not be the only diſeaſe, for hæmoptyſis itſelf would likewiſe ſeem in a conſiderable degree explainable on the doctrine of a hyper-oxigenation of the ſyſtem, without having recourſe to the ordinary way of attributing it chiefly to a *mechanical incapacity* of the reſpiratory organs, or to an *arterious plethora*; and this receives conſiderable ſupport from patients in hæmoptyſis being ſubject "to much ſenſibility and irritability"—the ingenium præcox Boerhaavii—as alſo from the inflammatory diatheſis that generally prevails, from the heat and ſenſe of pain in the breaſt, from the floridity of the blood, redneſs and flushings of the cheeks, &c. all which ſeem to corroborate the analogy between the two diſeaſes; and as they ſo conſtantly concur in each, a concluſion might be inferred, that hæmoptyſis ſhould be conſidered as an *incipient* phthiſis.

This explanation of hæmoptyſis likewiſe receives further confirmation from the known good conſequences that reſult in part from the ſame plan of cure; ſuch

as ſea-voyages, which ſeem to have been known even in the time of Pliny, as he ſays, "for the phthiſic or conſumption there is nothing ſo good as to ſail or be rowed upon the water, eſpecially upon the ſea;"* and the ſame naturaliſt, in another place, ſpeaks more directly in point, as appears from the following obſervation he makes:—"The ſea (ſays he) affordeth other uſes in ſeveral and many reſpects; but principally its air is wholeſome to thoſe that are in a phthiſic or conſumption, as I have before ſaid, and cureth ſuch as reach and void blood upwards: and truly, I remember of late, that Annæus Gallio, after he was made conſul, took this method, namely, to ſail upon the ſea for that infirmity. What think you is the cauſe that many make voyages into Ægypt? Surely it is not for the air of Ægypt itſelf, *but becauſe they lie long at ſea*, and are ſailing a great while before they arrive thither."†

Theſe facts of Pliny's are conſtantly confirmed by the daily experience of mariners, who are ſeldom or never ſubject to conſumption. The good effects of navigation, however, do not appear to ariſe entirely from the air of the ſea, but alſo from the proviſion uſed during the voyage, which is that of the animal kind; and hence probably the reaſon, together with the little exerciſe they take, why mariners are more corpulent than men who live on ſhore; for this ſpecies of food not only produces corpulency, but alſo a ſcorbutic ſtate of the ſyſtem, which, with the impurity of the air oftentimes

* Nat. Hiſt. tom. i. lib. 28. cap. 4. E.
† Lib. 31. cap. 6. L.

tentimes below and between decks, affords leſs of the reſpirable portion to the lungs in each inſpiration: and ſince ſhips, by means of Dr. Hales, have been ſo ventilated that the air may have a free paſſage through them, the ſcurvy, which before made ſuch ravages, has been leſs frequent in its appearance and leſs fatal in its effects.

Since, from all that has been ſaid, it is clearly evident, that both hæmoptyſis and phthiſis are induced according as there ſhall be preſent an *exceſs* of the principle of acidity in the ſyſtem, then certainly all thoſe means by which the ſyſtem may become ſuper-oxigenated ſhould be avoided, as alſo the adminiſtration of thoſe ſubſtances which have a great attraction for it, ſuch as iron, &c.*

May it not be aſked, whether the ordinary management of patients in either of theſe complaints, and the ſucceſs attending them, ſhew that they are treated after a method ſuitable to their cure? Daily experience demonſtrates the contrary—hence, we ſhould no longer adviſe patients ſo afflicted to haſten to breathe the country air, already made too pure by vegetable extrication; nor to diet upon vegetables and milk, or to make uſe of acidulous drinks;† but to purſue the direct contrary method above laid down, if they would wiſh for a radical ſolution of the diſeaſe: nor ſhould the exerciſe of equitation, &c. ſo much boaſted of in theſe

* May it not in a great degree be owing to the preſence of iron that ſome mineral waters are hurtful to conſumptive patients?

† Sub-acid liquors alone, it is ſaid, have induced conſumption, as has been experienced by ſome ladies, who, wiſhing to appear more than what they ſuppoſed ordinarily delicate, have made great uſe of vinegar, lemonade, &c.

theſe affections, be implicitly relied upon, as it is very probable they ſeldom or never do good without the intervention of ſome other circumſtances not properly attended to, and which are agreeable to the doctrine above expreſſed: thus the aborigines of our country have ſcarcely ever been obſerved to be affected with conſumption, which may eaſily be accounted for, not from the exerciſe they take, but by their living in damp woods and ſleeping on the ground, where they reſpire leſs pure air, which laſt alone has been ſaid to cure the diſeaſe.* This, however, is not the only thing: their food too, which is that of wild animals, contain conſiderable of the loſt principle and but little of the oxigenous. So alſo may it be with agriculturaliſts, who not only live in a great meaſure upon animal food, but alſo receive the exhalations of the earth, by ploughing, &c. The riding on horſeback, therefore, ſo much recommended by Sydenham and others, muſt certainly be hurtful on the ſingle conſideration of there being a larger volume of air expoſed to the ſuperficies of the lungs; and that this is injurious may alſo be ſufficiently confirmed from the benefit conſumptive patients receive in warm climates, where the air is not ſo condenſed, and where conſequently cæt. par. leſs is breathed.

The facts which have been related on the cauſe and cure of hæmoptyſis and phthiſis, will receive farther corroboration

* Van Swieten, in his commentaries on Boerhaave, tells us, on the authority of Solano de Luque, of the ſucceſsful practice of the BANOS DE TIERRA, or earth baths in hectic fevers and conſumptions, in Grenada, Andaluſia, and other provinces of Spain.

corroboration from the ſymptoms of the diſeaſe purpoſed to be next treated of, viz.

SCURVY.

Conſumption may not only be explained on the cauſes above alledged, but alſo have a greater probability of truth, from the ſymptoms that are obſerved to exiſt in ſcorbutus; for in this diſeaſe, in which there is a *diſoxigenated* ſtate of the ſyſtem, we do not diſcover that remarkable loſs of fleſhy matter, nor that hilarity of mind or floridity of the blood and fever, which are the ſure concomitants of conſumption: on the contrary, laxity and debility of the ſolids, paleneſs of the countenance, dark colour of the blood, and above all, a ſadneſs and depreſſion of ſpirits, appear ſure pathognomonics of this complaint: all which ſymptoms, it ſhall be endeavoured to be ſhewn, depend very evidently upon a *redundancy* of carbone in the blood and ſolids, and upon a *deficiency* of the vivifying and invigorating ſtimulus of oxigene.

The deſpondency of mind which is always apparent in ſcorbutics, and which is ſo oppoſite to what prevails in conſumption, would ſeem eaſily accounted for, by ſuppoſing the ſyſtem to contain an *exceſs* of carbone, which ſhall attract, abſorb or neutralize moſt of its oxigene; and in proportion as this ſhall be effected, will the production of direct debility, from the abſtraction of ſo powerful a ſtimulus, *approach to death or non-exiſtence of the quality of life*; for it would appear in truth, that the ſyſtem in ſcurvy is as much and as ſtrictly *ſu-*

per-

per-carbonated, as in consumption it was said to be *super-oxigenated*.

The dark colour of the blood, the vibices and ecchymoma that make their appearance in scurvy, would, from what has been said on consumption, seem to be owing to an *abstraction* of the principle of acidity; and therefore, as is the disposition of the system to phthisis will the floridity of the sanguineous fluid appear; and of consequence, as there shall be a *deficiency* of the above floridifying principle, the materials entering the composition of the blood must exist nearly or quite in their natural state and colour: and this appears to happen in the disease under consideration.

As iron is the chief material entering this circulating fluid, to which, in a state of oxidation, it owes its florid appearance; so therefore must the iron re-assume its pristine state and colour, when this floridifying substance shall be withdrawn in any disease wherein substances shall be present which possess a greater affinity or attraction for it than the iron. This is remarkably elucidated in scurvy, in which there appears such an *excess* of carbonaceous matter as to abstract from the iron all its oxigene, and leave it nearly or perhaps quite in its reguline or metallic state. There is, however, another way of accounting for the dark colour of the blood, and which may possibly be more conclusive;—the carbone itself, in substance, may enter the circulating mass, and thus tinge it of different shades, in proportion to the degree in which it shall be present. This receives considerable confirmation from the observations made by Lord

Lord Anſon's ſurgeons, who ſay, that "in the beginning of the diſeaſe the blood, as it flowed out of the orifice of the wound, might be ſeen to run in different ſhades of light and dark ſtreaks. Where the malady was increaſed, it ran thin and ſeemingly very black; and after ſtanding ſome time in a veſſel, turned thick and of a dark muddy colour. In the third degree of the diſeaſe, it came out as black as ink. Laſtly, as all other kinds of hæmorrhages were frequent at the latter end of the calamity, the fluid had the ſame appearance as to colour and conſiſtence."

From this account it would appear, that oxigene is not only abſent from the iron, but that the carbone itſelf is floating in the ſanguiferous ſyſtem, and thus the blood in the arterial is rendered of the ſame colour and compoſition which is exhibited by the venous blood in health; and hence the latter muſt be ſo fully carbonated as to loſe its connection with the iron by this abſtraction of the oxigene, which, when in juſt proportion, appears to be a cementing principle ſomewhat ſimilar to that remarked by lithologiſts to exiſt in minerals. This being the fact, it will no long remain a wonder why vibices and dark coloured effuſions appear in ſcorbutus.

The offenſive breath *(dyſodia pulmonica)* and the high colour of ſeveral of the excretions in ſcorbutics, ſeem alſo to ariſe from the new combinations that are formed on the decompoſitions above alluded to;—part of the hydrogene may unite with the azote and form an ammoniacal compound; or the azote may combine with a ſmall proportion of oxigene in ſuch a way as to form

form the oxyd of azote or nitrogene; or again, the hydrogene may combine with the phoſphorus or carbone, and form phoſphorated or carbonated hydrogene gaſſes; and it would ſeem to be by theſe different combinations variouſly modified, that not only the above ſymptoms of ſcurvy, but perhaps all cutaneous eruptions, diſeaſes, or ulcers whatſoever, in which there appears to be an acrimony of the circulating fluids, ſuch as ſcrophula, eriſipelas, lepra, cancer, &c. are to be explained: and by theſe various modified combinations perhaps alſo every ſpecies of contagious matter whatſoever may be generated or produced in animal and vegetable bodies.

That ſcurvy is the direct effect of ſuper-carbonation of the ſyſtem, is further proved from the experience of thoſe who are obliged to live principally upon animal food, eſpecially that which is in a ſtate of putreſcence, which every one knows is already in an incipient decompoſition, and hence may the more readily yield its carbone in the digeſtive proceſs. Many more facts, however, might be adduced, if it were neceſſary, to ſupport what has already been advanced concerning the tendency of animal food to induce ſcurvy; ſuch, for inſtance, as what has been related by Sinopœus, who obſerves, "there are whole nations in Tartary, who live altogether on fleſh and milk, and which people (ſays he) are ſubject to the moſt violent ſcurvies."*

Theſe are not the only cauſes to which ſcurvy has been attributed, for many conſider cold and moiſture as highly

* Parerga Medica. p. 311.

highly conducive to the diſeaſe. Theſe opinions, however, are conſiderably doubtful, unleſs they ſhould be conceived as inducing their ill effects in the way Sanctorius aſſerts; "for (ſays he) too cold windy or wet weather leſſens perſpiration;"* and the perſpiration being thus obſtructed, he goes on—"it converts the matter of tranſpiration into an ichor, which being retained, induces a cachexy."† Sanctorius appears ſomewhat juſt in his concluſions, by ſuppoſing and deſcribing what he thought humidity of the air as favouring the diſeaſe, which concluſions he drew from his ſtatical experiments, wherein he further relates, concerning this obſtructed excretion in ſcurvy, "that here perſpiration is ſtopped, the paſſages of it clogged, the fibres are relaxed; and the tranſpiration of it retained proves hurtful."‡ But theſe latter aſſertions of Sanctorius can only be partially admitted as cauſes of ſcorbutus; for it would appear, that cold air was not *alone* the cauſe, but if any thing rather beneficial, agreeable to what has been already obſerved on conſumption, in which complaint experience gives great atteſtation in favour of a warm climate; and for directly contrary reaſons muſt it be beneficial in this, becauſe of there being a greater quantity of oxigene air received into the ſyſtem by ordinary reſpiration in a cold climate, where the atmoſphere is more condenſed, than in a warm one, where it is more rarified: and conſequently the ſyſtem will ſtand

* Medicina Statica. aph. 200.
† Ibid. aph. 146.
‡ Ibid. aph. 148.

a greater chance of becoming oxigenated in the former than in the latter.

As to the obſtructed cuticular or pulmonic exhalations being conſidered another cauſe of ſcurvy, theſe likewiſe would not ſeem altogether ſatisfactory, unleſs the ſyſtem ſhould be in a ſtate of *prediſpoſition*, by being already *ſuper-carbonated*, and then all that experienced man has ſaid may be admitted; for in this ſtate of ſuper-carbonation, when the cuticular excretion ſhall be obſtructed and retained, will all the ſubſtances the perſpirable vapour contained become in ſome degree fixed, or form other combinations.

As it appears that carbone is a prevalent ingredient of the fleſhy parts of our bodies, it conſequently muſt exiſt alſo in a conſiderable proportion in the above excretion; and that this is fact, has been proved by the experiments of the Count de Milly and others, who have collected large quantities of carbonic acid gas during its evolution from the ſurface of the body: this gas, then, being retained in the ſyſtem, is very obviouſly an additional help to a diſeaſe depending upon too much of the ſame material. This explanation is further concluſive on the conſideration that obſtructed perſpiration is not alone, but that *ſuper-carbonation* of the ſyſtem is alſo a cauſe of ſcurvy; and this is agreeable to the above obſervation of Sinopœus; for the food of thoſe people, although they lived near the frigid zone, yielded the noxious material.

The doctrine of ſuper-carbonation of the ſyſtem is ſtill further ſtrengthened from there appearing no febrile heat

heat in ſcurvy, which is known to exiſt, in a conſiderable degree, in phthiſis; as alſo from the circulation being languid, and from the torpor and debility of all the functions,—vital, animal and natural, which fully demonſtrate a deficiency of the vivifying power of oxigene.

The Deliquia, too, attending ſcurvy, ſeem ſtrongly to argue the deleterious agency of carbone, when it exiſts *internally*, as well as when it is applied *externally*, in the ſtate of gas, in too great quantities, to parts poſſeſſing much irritability; as it may, by its *direct* internal application to the vital "medullary nervous matter and muſcular ſolid," abſtract from them the principle that gave them irritability; and hence, in proportion to the degree in which this application ſhall be made, will the ſtate of inanimation, or the torpor and debility of the ſolids, whether vital or animal, be produced; and this abſtraction of the oxigenous principle, if carried to the greateſt degree, will, by inducing *direct debility*, cauſe *ceſſation of animal exiſtence altogether*, and this as effectually as in the oppoſite ſtate of the ſyſtem, when, by the too great preſence of the oxigene, the animal is *ſtimulated to death.*

That the carbonaceous principle, when in too great accumulation in the ſyſtem, poſſeſſes a power of extinguiſhing its ſuſceptibility of ſtimuli altogether, is a fact clearly demonſtrated by the weakneſs and feebleneſs of the pulſe, by the whole ſyſtem of ſolids being in a weakened and relaxed condition, and even by the putridity of the heart itſelf.*

The

* Lind on Scurvy, p. 312.

The concluſion, then, from all that has been delivered, ſeems clearly apparent, that ſcurvy originates from the ſame cauſes both upon land and ſea, and appears to be the ſame diſeaſe ever ſince the firſt account we have of it on the latter by Vaſco de Gama;* and therefore, "if the axioms for the ſtudy of nature, in the material inanimate world, be alſo applicable to the various modes of life and organization," then we may underſtand why "effects of the ſame kind may be aſcribed to the ſame cauſes; and the qualities of phænomena diſcovered by experiments, may be conſidered as univerſal qualities of phænomena of the ſame kind," in diſeaſes of the human conſtitution, as well as in other caſes.

To put the matter, however, beyond the poſſibility of doubt, that they are both induced by the ſame identical cauſe, viz. ſuper-carbonation of the ſyſtem, the method of cure will in both appear to be the ſame, that is, exactly ſimilar to the common practice which induces conſumption.†

CURE.

FROM the foregoing obſervations, ſcorbutus appears to be a diſeaſe exiſting only in proportion as the ſyſtem

* See the Hiſtory of the Portugueſe Diſcoveries, &c. by Herman Lopez de Caſtanneda.

† That the ſymptoms of ſcurvy above enumerated are poſitive facts may be evinced from conſidering the caſe of the PUER CÆRULEATUS of Sandifort, as related in the "Obſervationes Anatomico-Pathologicæ, Lugd. Batav. 1777, p. 11. & ſeq." which caſe is alſo quoted by Beddoes, in his "Obſervations on the Nature and Cure of Calculus, Sea-Scurvy," &c. p. 63, but which is too lengthy for inſertion in a publication of this kind.

ſyſtem ſhall be carbonated, or as it ſhall be in a condition oppoſite to that which exiſts in conſumption, and therefore, to obtain a radical cure, muſt neceſſarily be treated by contrary remedies.

The firſt and moſt powerful remedy calculated to effect a ſpeedy cure appears to be that of oxigene air, received by reſpiration; and this will the more fully be underſtood, when we conſider that it is the only "*breath of life*," as all the other gaſſes either cannot ſupport, or immediately deſtroy the *living quality* of organized matter. As this is a condition of the ſyſtem in which *life* approaches nearly to a ſtate of *non-exiſtence*, that nouriſhing principle or ſupport of life is therefore required which the ancients denominated *pabulum vitæ*; for Hippocrates poſitively ſays, "*Principium alimenti ſpiritus.*"* This *pabulum vitæ*, or *breath of life*, then, which is *eſſential* to animal exiſtence, we find in the baſe of oxigene air, the operation of which animating ſtimulus, as ſoon as it is received into the ſyſtem of patients in this moribund complaint, will, on its decompoſition, diffuſe heat, life and vigour throughout the conſtitution.

Next to this *empyrean* gas, which is proved to poſſeſs the *only* principle by which the quality of animation can be excited in organized matter of the human type, poſſeſſing a ſuſceptibility of its ſtimulus, we ſhould ſeek for thoſe ſubſtances that contain the oxigenous principle in the greateſt quantity, having at the ſame time ſuch a ſlight attachment for it, that this *animating* ſtimulant

* Hippocrat. de Alim. v. 68.

ſtimulant may be diſengaged, and thus enter the ſyſtem by the primæ viæ, as well as when it is received in the manner above expreſſed.

It has been obſerved, that ſome of the mineral acids do not cure the ſcurvy ſo ſpeedily as the acetous, citric, oxalic, tartaric, &c. this, however, is eaſily underſtood, for the oxigene in thoſe acids appears to be in ſuch firm combination with their radicals as not to ſuffer decompoſition like the vegetable claſs.

Of all vegetables the Citrus ſtands firſt on the liſt in the cure of this diſmal and deadly diſeaſe; and it is to this alone that Lord Anſon attributes the cure of his men in the iſland of Tinian, as well as many others who highly extol it;* and it is upon this that Kramer ſolely relies.†

The citrus having been long experienced to be more beneficial than any other vegetable ſubſtance, may be owing to its containing a larger proportion of oxigene, and leſs of carbone, azote, &c. than other plants; and this appears to be the reaſon why thoſe alſo of the Tetradynamous claſs are greatly recommended; for the ſmall proportion of azote, &c. they are found to poſſeſs, is far more than compenſated for by their exuberance of oxigene.

Scurvy, however, would not appear to be the only diſeaſe occaſioned by an hyper-carbonated ſtate of the ſyſtem, for many others, eſpecially thoſe belonging to the claſs of Neuroſes, ſeem to depend upon a want of the

* Mead's Diſcourſe on the Scurvy, p. 111.

† Krameri Medicina Caſtrenſis, part iii. cap. 2.

the vivifying ſtimulus that oxigene affords; ſuch, for inſtance, are paralyſis, ſyncope when it ariſes from direct debility, dyſpepſia, hypochondriaſis, chloroſis, tetanus, triſmus, convulſio, chorea, epilepſia, aſthma, dyſpnœa when it ariſes from debility or paralyſis of the muſcles of the larynx, cholera, chronic diarrhœa, hyſteria, hydrophobia, amentia, melancholia, and cholera infantum, &c. which laſt ſeems to be almoſt poſitively confirmative of this doctrine; for "out of many hundred children," ſays Ruſh,* "whom I have ſent into the country in every ſtage of this diſorder, I have loſt only three;" two of which, the Dr. ſays, did not follow his directions; and he proceeds—"it is extremely agreeable to ſee the little ſufferers revive, as ſoon as they eſcape from the city air and inſpire the pure air of the country." A fact of the ſame nature was related to me by Profeſſor Smith, whoſe child was very ill of this diſeaſe, and grew better on his leaving this city to go with it to New-Jerſey: the paſſage was at night, and conſequently the air more condenſed: the infant, which was carried in his arms in the open air, was well clothed to prevent the ill effects that might perhaps have ariſen from the application of cold air to the ſurface of its body, ſo that the face only could be expoſed, and hence the operation of the air could only have been on the *reſpiratory organs*.† That the cure depends upon the influence of oxigene is further evident from the uſe of acids, eſpecially the vegetable; for Profeſſor Smith had two

* i. Med. Inq. p. 118.

† Many more facts might be adduced of the beneficial effects of country air from the obſervations of Profeſſors Hamerſley, Rodgers, &c.

two patients that were immediately cured by the uſe of the acetous acid,* a proportion of which was taken without his knowledge, and the cure effected much to his ſurpriſe. Vegetable acids probably operate in the way related of them in the cure of ſcurvy.

All the ſymptoms of typhus ſeem alſo evidently to depend upon its abſence; and it is highly probable, if oxigene air ſhould be adminiſtered by way of reſpiration, there would be happy conſequences ariſing from its exhibition; and this is rendered evident from the common practice of hanging up or placing young and vigorous plants in the apartments of thoſe labouring under the diſeaſe; for ſuch plants not only perſpire a large quantity of vital gas, but alſo inhale the mephitic. The efficacy of acids alſo, eſpecially the vegetable, as poſſeſſing the property above related, is likewiſe to be accounted for on the ſame principle.

On the contrary, the claſs of Cachexiæ, as well as that of Phlegmaſiæ, may depend upon an *exceſs* of oxigene; as, anaſarca, aſcites, hydrothorax, &c. in which diſeaſes the oxigene may combine with the hydrogene, and form the ſerous fluids obſervable in them; and hence, for contrary reaſons, the inſpiration of carbonic acid and hydrogene airs muſt be very ſerviceable. The remarkable loſs of fat in the omentum, viſcera, &c. renders it ſtill more probable that theſe diſeaſes depend upon a too high oxigenated ſyſtem.

Should what has been advanced hereafter prove true, it would ſeem neceſſary that a new Noſological arrangement

* Perhaps the acid may have had a phyſiological as well as a chemical action.

arrangement of diſeaſes ſhould be formed, and claſſed, according as they are induced, either by an exceſs of oxigenation, or by the different ratios of proportion which the ſeveral ingredients, oxigene, hydrogene, carbone, iron, &c. bear to each other in our conſtitutions.

It may not be improper here to obſerve, that if, in the living human body, (and all others, perhaps) decompoſitions and new combinations ſhall take place, as has been above endeavoured to be made apparent, then it may not be difficult to conceive that the Humoral Pathology, which has of late been in ſome meaſure exploded, ſhall receive ſome cogent arguments in its favour; for, according as the above related decompoſitions and new combinations ſhall enſue, will great alteration take place in the circulating humours, which in their *peccant* proportions may induce diſeaſes and death; and the correction and adjuſtment of the proportions of which is unqueſtionably, in many caſes, one of our rational indications of cure.

In tracing *all* diſeaſes, therefore, to the ſolids alone, as Milman has done, (who ſeems almoſt to have conſidered the fluids *as uſeleſs parts* of the conſtitution) there is certainly a radical error.

Since, therefore, decompoſitions and new combinations, variouſly modified, are conſtantly taking place throughout *animate* as well as *inanimate* matter, and of which we have ſuch manifold experience, it would ſeem, that a doubt could ſcarcely reſt with any one, that each and every of us, have, or ſhall participate of the different modes of exiſtence that matter, organized or

 inorganized,

inorganized, aſſumes in the different grades of creation —*from man to the lithophyte*,*—*from* " *the cedar that is in Lebanon to the hyſſop that ſpringeth out of the wall*," —*from the mite to the elephant:*—thus ſubſtantiating the ſayings made of old—

——" Quocumque flexeris te, habebis ibi DEUM occurrentem tibi: nihil vacat ab illo, ipſe implet opus ſuum."——

——" JUPITER eſt quodcunque vides, quocunque moveris."——

" The ſyſtem one, one Maker ſtands confeſs'd;
" The prime, the one, the wond'rous and the bleſt;
" The one on *various forms* of UNITY expreſs'd."

* " Thou almoſt mak'ſt me waver in my faith
To hold opinion with Pythagoras,
That SOULS of animals infuſe themſelves
Into the trunks of men."

FINIS.